

Remarks

Claims 1-3 were rejected as unpatentable over TING et al. 5,969,422 in view of BLISH, II et al. 5,882,738 and DOAN et al. 5,372,974. Claim 3 was also rejected as unpatentable further in view of DUBIN 6,077,780. Claim 1 has been amended and reconsideration and withdrawal of the rejection are respectfully requested.

Claim 1 is directed to a method for manufacturing a semiconductor device in which a tantalum-base barrier film is formed in a contact hole, via hole or trench, a copper-based conductive film is formed on the tantalum-base barrier film, and a tantalum oxide film is formed between the interlayer insulation film and the tantalum-base barrier film at an interface surface therebetween and at a same time an amorphous metal film comprising tantalum and copper is formed between the tantalum-base barrier film and the copper-based conductive film at an interface surface therebetween by heat treating the semiconductor substrate with the tantalum-base barrier film and the copper-based conductive film in a non-oxidizing atmosphere.

The proposed combinations of references do not disclose or suggest at least the last step of this process; namely the step in which the tantalum oxide film is formed between the interlayer insulation film and the tantalum-base barrier film and at a same time an amorphous metal film comprising tantalum and

copper is formed between the tantalum-base barrier film and the copper-based conductive film by heat treating the semiconductor substrate in a non-oxidizing atmosphere.

TING et al. disclose the formation of the tantalum-base barrier film in a contact hole, via hole or trench and the formation of the copper-based conductive film on the tantalum-base barrier film. The Official Action acknowledges that TING et al. do not disclose the heat treatment in the non-oxidizing atmosphere and the tantalum oxide film, and relies on BLISH, II et al. and DOAN et al. for the suggestions to modify TING et al. to include these steps.

TING et al. disclose that the amorphous metal film is deposited in a separate step (see for example claim 15 of the reference), and BLISH, II et al. disclose that the barrier metal is transformed to an amorphous structure by ion implantation (see for example claim 1 of the reference). DOAN et al. disclose a tantalum oxide layer. However, absent from this combination is a suggestion to form the tantalum oxide film between the interlayer insulation film and the tantalum-base barrier film and at a same time to form the amorphous metal film between the tantalum-base barrier film and the copper-based conductive film by heat treating the semiconductor substrate in a non-oxidizing atmosphere. The references together do not motivate one of skill in the art to pull all of these disparate steps together to form

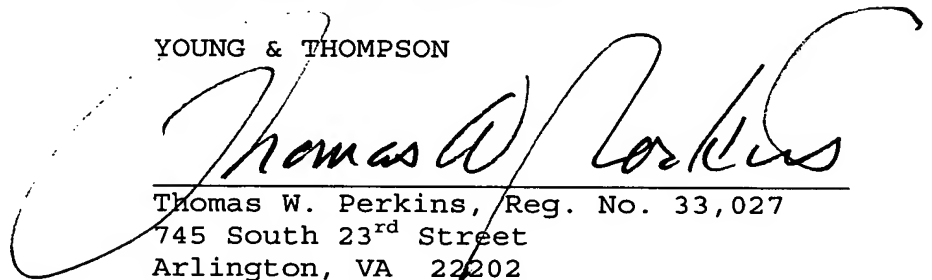
both the tantalum oxide film and the amorphous metal film at the same time by heat treating the substrate in a non-oxidizing atmosphere. Accordingly, amended claim 1 avoids the rejection under §103. Claims 2-3 are allowable for the same reason.

In view of the present amendment and the foregoing remarks, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. §1.16 or under 37 C.F.R. §1.17.

Respectfully submitted,

YOUNG & THOMPSON

A large, stylized handwritten signature in black ink, which appears to read "Thomas W. Perkins". The signature is written over a horizontal line that separates it from the printed contact information below.

Thomas W. Perkins, Reg. No. 33,027
745 South 23rd Street
Arlington, VA 22202
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

TWP/lrs